Digital Computer Laboratory
Massachusetts Institute of Technology
Cambridge 39, Massachusetts

SUBJECT: BI-WEEKLY REPORT, February 1, 1952

To: Jay W. Forrester

From: Laboratory Staff

1.0 SYSTEM OPERATION

1.1 Whirlwind I System

(S. H. Dodd)

Tests have been run on Bank B Storage in an effort to determine optimum rewrite times. For these tests a special program was written which gives continuous reading operations on each individual spot at an unusually high repetition rate. The series of tests which were made will have to be continued before any final conclusions can be reached. The results to date however, indicate two major effects: (1) Some tubes lose read-out pulses from positive spots after the positive spot has been read several times. When these spots are observed using TV, positive spots are still there. This indicates that during the read-out, the charge on the spot is deteriorated far enough to lose read-outs but not far enough to switch negative. This trouble occurred on about four tubes and could be corrected by reducing the read-gate amplitude to approximately 50% of its normal value. The effect of this reduction of gate amplitude on other operating conditions has not as yet been investigated. (2) Even with the rewrite High Velocity Gun Gate suppressed, the beam causes heavy positive spot expansion in a few of the storage tubes. This effect is presumably due to different reading beam current or distribution in these tubes.

The Marginal Checking equipment operation during the last few weeks has been quite erratic causing a substantial loss in time during the Marginal Checking period. Investigation of the troubles indicates that this is largely due to the operation of the old cross-bar switch. A new set of Control Panels will be designed to operate with a new cross-bar switch and will be used to replace the present system.

A large number of intermittent failures have been encountered during the last by-weekly period. Examples of these are: (1) An intermittent short in the High voltage section of HV Cathode Supply, (2) An intermittent open filament in a tube in the control circuits of the High Voltage Cathode Supply,

1.1 Whirlwind I System (continued)

(3) A poor video cable connector in the ES Erase Control, (4) A loose connection in the power wiring caused during an installation period. Efforts are being made to correct these troubles by inspection means where possible.

Intermittent operation of the Computer for a period of several days was traced to the use of the Emergency Power System in the input to the DC supplies. Return to operation with the plate alternator corrected this trouble.

(N. L. Daggett)

Two rather troublesome intermittents were encountered recently. One, an occassional gain or loss of spots in ES, was traced to a faulty gate and delay unit in the temporary Erase circuit. The other, which appeared as a random shift in ES deflection was found to be caused by power supply transients which occurred because the d-c supplies were fed directly from the Cambridge line while work was being done on the plate alternator. This latter trouble demonstrates the very definite value of the plate alternator in isolating the computer from line transients.

(H. L. Ziegler)

With most of the time during this by-weekly period being devoted to trouble-shooting of intermittent faults in ES Storage, little was done toward modifying ES Control. When the present storage difficulties have all been cleared up an attempt will be made to eliminate the previously mentioned "dead time" in the E. S. Control cycle.

Some time was spent on a study of Rewrite and its effect on ES operation. This work is being continued at the present time.

To check the effect of modifications to the RF Pulser during the past few months it was realigned. There are still a few items to be corrected on this panel before it is given a final alignment.

(H. F . Mercer)

Storage Tube Failures in WWI.

The following storage tube failures were reported during this bi-weekly period:

1.1 Whirlwind I System (continued)

RT-259 was rejected after 175 hours of operation because of low HVG current.

RT-280 was rejected after 165 hours of operation because of marginal operation and non-uniform storage.

RT-243 was rejected after 1252 hours of operation because of holding gun failure.

Storage Tube Complement in WWI.

The following is the storage tube complement of both Bank A and Bank B as of this date:

	Bank A			Bank B		
Digit	Tube	Hrs. at Install.	Hrs. of Operation	Tube	Hrs. at Install.	Hrs. of Operation
0	ST337	4049	1941	RT233	4722	1268
1	ST325	2810	3180	RT250-R1	5866	124
2	ST346	4669	1321	RT247	5198	792
3	ST341	5046	944	RT234	4705	1285
4	ST353	4793	1197	RT278	5638	352
5	ST344	5044	946	RT237	4714	1276
6	ST328	2636	3354	RT231	4687	1303
7	ST320-R1	4215	1775	RT241	4737	1253
8	RT287	5703	287	RT251-R1	5976	14
9	ST305-2	2004	3986	RT244	4726	1264
10	ST329	3094	2896	RT246	4773	1217
11	ST351	5067	923	RT248	4861	1129
12	ST350	5134	856	RT258	5207	883
13	ST354	4717	1273	RT282	5417	573
14	ST357	5118	872	RT230-R2	4726	1264
15	ST358	5145	845	RT255	5150	840
16	ST359	5279	711	RT300	5958	32

One column gives ES clock hours at the time of installation for each tube and another column gives the total hours of operation in the Computer for each tube through February 1.

ES clock hours this date 5990.

Operation

The following is an estimate by the Computer operators of the usable percentage of assigned operation time and the errors due to the Computer. This covers the period 21 January through 31 January:

1.1 Whirlwind I System (continued)

Number of assigned hours	69
Number of transient errors	21
Number of steady state errors	8
Number of intermittent errors	22
Percentage of assigned time usable	73
Percentage of assigned time usable since March 1951	86

(L. O. Leighton)

Component Failures in WWI

The following failures of electrical components have been reported since January 18, 1952:

Component	No. of Failures	Hours of Operation	Reason of Failure
Capacitor			
4 MFD Inverted Can (oil filled)	1	1280	Insulation Break Down
Tubes			
7AD7	1	3808	Low I_b
	4	8000-9000	1-Mechanical 3-Low I_b
	2	9000-10000	Low I_b
6SH7	2	1-2160 1-3221	Low I_b
3D21A	1	915	Low I_b
2C51	2	1-1297 1-5059	Open

1.1 Whirlwind I System (continued)

Component	No. of Failures	Hours of Operation	Reason of Failure
715C	1	5841	Open
5U4G	1	7297	Gassy
6AS7	2	1-593 1-360	Mechanical

1.2 Five-Digit Multiplier

(C. N. Paskauskas)

The multiplier operated satisfactorily during this period except for a string of errors early in the morning of January 29. This was apparently due to low line voltage.

During the period of this report the following were replaced as a result of marginal checking:

1 6AG7 amplifier tube 21227.1 hrs. in service
2 6AS6 gate tubes 4069.4 hrs. in service

2.0 CIRCUITS AND COMPONENTS

2.1 Circuits by System Number

2.14 Input-Output

(R. L. Best)

Experiments are under way with the decoder and display scope system to improve the signal-to-noise ratio.

2.2 Vacuum Tubes and Crystals

2.21 Vacuum Tubes

(H. B. Frost, L. Sutro)

Various modifications to the tube-shop test equipment are being planned and executed as convenient. 1) The tap short detectors have been changed so that leakage resistances below 10 megohms and those below 100 kilo-ohm can be differentiated. Previously only those resistances below 10 megohms were indicated, with no effective distinction between low and high resistances. 2) Vacuum tube voltmeters are being built into the two console testers. These will fulfill the same purpose as present external meters, which are somewhat inconvenient and dangerous to use. 3) A complementary circuit is being planned for the vacuum-tube pulse-current tester. This work is awaiting delivery of some special switches, which are expected to be delivered next week.

(H. B. Frost)

An Engineering note, E-443, Interface Formation in 6AG7 Tubes, has been completed. The behavior of interface resistance versus time was measured for G.E. and R.C.A. 6AG7 tubes over a period of 1000 hours. A sample of 5 G.E. and 4 R.C.A. tubes was run. At the end of 1000 hours, the G.E. tubes had interface resistances if 100 ohms measured at 6.3 volts; the R.C.A. tubes had less than 5 ohms when measured at 3.5 volts on the heater.

2.22 Transistors

(N. T. Jones, J.F. Jacobs)

The complete set of parameter data including Land Camera photos of characteristics of all transistors has been taken and recorded in the Transistor Parameter and History Notebook. These measurements have shown the need to make several changes in the standard test circuits as reported in E-441, Standardized Transistor Parameter Measurements. These changes will be reported in an E-note in the near future. Other E-notes are planned for transistor parameter variations between units and with time, and evaluation of the E-441 scheme of measuring parameters. Work

2.22 Transistors (continued)

(N. T. Jones, J. F. Jacobs) (continued)

is being done by P. Marino, B. Schmidt, and L. Riley on various aspects of each of these problems.

A panel to take all dynamic characteristics of a transistor is nearing completion and should be operating before this bi-weekly is published. This panel will aid the parameter study.

The stabilized single transistor flip-flop that has been discussed and analyzed sporadically over the past few weeks, was operated stably over a prf range of 10 cps to 1 mc. Rise times of 0.05 to 0.10 microsecond were achieved with Bell and GE transistors. The circuit required large trigger pulses and gave a low voltage swing in the output. Work on this circuit continues.

Three other counter circuits have been built by S. Teicher, but have not been operated as yet. These include a two-transistor flip-flop, a second type of single transistor flip-flop, and Felker's regenerative amplifier-delay line dynamic flip-flop. Analysis of the single transistor circuit is being done by S. Teicher.

A prototype regulated power supply for use with transistor circuits is being designed and tested by L. Riley.

Work on pulse amplifiers as a possible thesis subject is being done by Art Heineck.

2.23 Crystal Diodes

(H. B. Frost)

A modified scheme for determining dynamic back resistance of crystal diodes has been devised. A theoretical analysis of the previous scheme indicated some difficulties might be expected when high-back-resistance diodes were being tested. The new method causes the diode under test to draw continuous forward current, which may be adjusted within a reasonable range, except during a five-microsecond interval when the back resistance is being examined. Very different performance was found when sample crystals of four manufacturers were examined. The dynamic back resistance did not appear to correlate too closely with the static back resistance measurements. This work has been held up slightly by lack of availability of the DuMont scope camera.

2.3 Ferroelectric and Ferromagnetic Cores

(B. Widrowitz)

16 x 16 Metallic Array

New controls were designed for the current drivers. These have not been tested yet. A survey of power requirements was made in preparation for moving to Whittemore.

The past week was spent on vacation. During that time, the moving took place. Present efforts are restricted to the restoration of operation of the system.

(K. H. Olsen, E. A. Guditz)

Ceramic Array and Switch

A new 16 x 16 array of an improved material, MF 1118, has been assembled. The signal-to-noise ratio of this material is much better than the MF 666 presently used.

A new set of drivers for the array have been layed out and are now being constructed in the shop. It is expected that they will be incorporated into the memory in the next period.

(D. A. Buck)

Ferroelectrics

A visit was made to J. R. Anderson of the Bell Telephone Laboratories to discuss ferroelectric storage problems. His work has been entirely with single crystals of barium titanate grown in that laboratory, while work here has been with polycrystalline ceramics.

An 8-position ferroelectric matrix switch was fired on a one-inch square of ceramic barium titanate and is at present under test to evaluate the technique. If successful, it will suggest the possible use of printed-circuit techniques for pulse-operated switching circuits.

An analysis of the selection ratio for magnetic matrix memories as affected by the quiescent internal impedance of the row and column drivers was issued as memorandum M-1381.

2.3 Ferroelectric and Ferromagnetic Cores (continued)

(R. L. Best)

Pulse Test Equipment

The single-turn ferrite-core tester has been modified. A special panel has been built to replace three Gate and Delay Pulse Generators which were needed elsewhere. The gates are used to trigger the 2D21 thyratrons used in the pulse forming circuits.

(J. H. Baldrige)

A library investigation is being carried out in order to determine suitable methods for the analysis of materials pertinent to ferromagnetic research and equipment and reagents are being obtained for this purpose. The analyses will be carried out in Room 20 C 001, under the direction of Prof. F. E. Vinal of the Laboratory for Insulation Research.

2.6 Component Analysis

(B. B. Paine)

Slight modifications will be made to the Model 2 crystal tester used in the stockroom to provide a better test for 1N38 crystals and to make operation easier in routine acceptance tests. These changes are described in E-445.

Thirty delay lines have now been made by Paul Grant's group according to a modified form of Jim Hanson's note E-437. These have brass screw stud terminals rather than pigtail leads, and cast-plastic end caps will be applied as soon as the molds are ready.

Simplification of our stock of capacitors and preparation of standards sheets is in progress.

3.0 STORAGE TUBES

3.1 Construction

(P. Youtz)

Three 500-series storage tubes were processed this past bi-weekly period. These tubes are similar to the 400-series storage tubes with the following exceptions:

1. The high velocity gun throw is $\frac{1}{2}$" shorter.
2. The holding gun throw is 1" longer.
3. The collector frame is stronger.
4. The springs are longer so that the collector and auxiliary collector screens may be held under greater tension.
5. After the target and body seal, the storage tube is given a complete bakeout on System 5 before the guns are inserted.

Also, four storage tubes were reprocessed this past period.

We have scheduled one 500-series storage tube each day for the next two bi-weekly periods to get replacements for Bank B.

3.2 Test

(C. L. Corderman)

Four additonal 32 x 32 tubes have been aligned at the STRT to be used as WW replacements. Two of the tubes have the stannic-oxide coating in place of the dag and must be operated with a VHG greater than 120 volts. However, during tests at the STRT with VHG = 145 volts, the tubes both exhibited good margins of operation. The two remaining tubes were both reprocessed. They had previously been in the computer for a short time and were rejected because of low emission.

The first two tubes, RT301 and RT302, of a new production run have been partially pretested. They utilize the dag coating formerly in use, but have had a vacuum bakeout prior to sealing in the guns. Both tubes had lower switching voltages above that of previous dag tubes and an attempt is being made to correlate this observation with the processing and evaporation schedules. RT301 is not usable because of an area having a very high switching voltage, but RT302 can probably be used by operating with VHG 120 volts.

(A. J. Cann, R. E. Hegler)

During this period no pretesting was done but preliminary observations were made on RT-299-RI, RT-300, RT-297, and RT-253-RI. All except the last were rejected for high lower switching voltage. RT-253-RI had focusing difficulties but was sent on to STRT.

3.2 Test (continued)

(A. J. Cann, R. E. Hegler) (continued)

Some array rotating circuits suggested by Herb Platt were tried out in the TVD. A satisfactory circuit which permits 5 degrees rotation each side of center was developed using only resistors and ganged potentiometers; no tubes or crystals.

Roy Hegler has begun to learn the operation of the TVD and the maintenance of the storage tube records.

The second week of this period was spent on vacation.

(T. S. Greenwood)

As of January 25, the type "L" cathode tubes on life test had accumulated the following total hours:

RT-264	-	1775 hrs.
RT-265	-	1560 "
RT-267	-	1440 "
RT-268	-	1296 "
RT-294	-	560 "

At the close of the previous period, another power failure occurred in the life test racks and was traced to high line voltage (taken off a variable transformer). This was lowered and it was no longer possible to maintain the filaments of RT-267 and 268 and 10.0 volts and these have since been operated at 9.4 volts.

At the time of the change (due either to the power failure or the lowered filament voltage) the beam current of RT-267 fell to 1/6 of its former value. It has since remained stable at this value (12 micro-amperes). This change in current will be investigated further.

No significant change was noted in RT-268; however, for no apparent reason the current in RT-265 increased by 30%.

The last week of the period was spent on vacation.

(H. J. Platt)

Three days of this bi-weekly period were spent at the AIEE Winter Convention. During the second week of this period, I was on vacation.

(A. M. Stein)

Assembly of the test set-ups to be used for the study of beam current distribution continues. Adjustment of the various timing circuits has already been started.

The second half of this bi-weekly period was spent on vacation.

3.2 Test (continued)

(J. Jacobowitz)

I have been familiarizing myself with the STRT block diagrams and learning some details of its operation.

The second week of this period was spent on vacation.

3.3 Research and Development

(H. J. Platt, C. L. Corderman)

The design of a 1024 mosaic tube has been started. This tube will have one mosaic square for each storage spot and a thicker mica surface. A tube of this type should have lower access time and reduced spot interaction.

Some problems associated with this type of operation were presented and discussed in a thesis proposal, M-1365. A possible solution to the problem of misalignment of the sides of the array with the deflection plates is to rotate the surface electronically. This may be accomplished by feeding the deflection voltages to a bridge circuit and tapping off the deflection plates at the values for proper rotation. The problem of keystoning, due to the off-center high-velocity gun, may be eliminated by producing the reverse effect within the storage tube, i.e., by using a trapezoidal array of squares. Calculations for wire spacings for the mosaic were carried out with corrections made for keystoning.

4.0 TERMINAL EQUIPMENT

4.1 Typewriter and Tape Punch

(L. H. Norcott)

Modifications of a second "FL" flexowriter were completed and the flexowriter placed in use in the tape preparation room. The third should be finished by February 5.

On January 24th, Mr. Scott Cass, Vice-President of Commercial Controls Corp., visited Whirlwind and was informed of the trouble we are having trying to perforate our gray unoiled paper tape on the "FL" punches. He promised to turn this problem over to his engineering department and attempt to find a satisfactory solution for us.

Paper Manufacturers Company, suppliers of our gray tape, advise us that they have been attempting to develop a softer paper than we are now using and will advise us as soon as some is available.

4.2 Magnetic Tape

(B. Ginsburg, K. McVicar)

When carefully adjusted, the interim magnetic tape system seems to be fairly reliable. On Saturday, January 19 we recorded and checked over half-a-million registers, during a period of about three hours, without an error.

One of the more important problems remaining concerns the magnetic tape unit itself. The tape does not run true on the pulleys with the result that the tape is skewed somewhat when run backwards. This upsets the relative position of the pulses on the six different channels and complicates the timing of the sensing pulse.

(E. P. Farnsworth)

Several marginal germanium diodes have been located and replaced in the magnetic tape printing-out decoding gates and switching matrix.

Automatic carriage return has been provided on the Flexowriter printer and magnetic tape simulator to facilitate testing of the system. Printed page is now obtained without attention to the equipment.

Firing and extinguishing of the thyratron decoding register at the printer cycling rate applies a step function load to the plus 150 volt supply. The resulting voltage fluctuation is excessive and has necessitated construction of a separate low voltage high current power supply having adequate regulation.

4.0 TERMINAL EQUIPMENT (Continued)

4.3 Display

(R. H. Gould)

The smearing of parts of displayed pattern that appeared when the new decoders were used has been traced to oscillation in the decoder output amplifier. It is cured by adding more capacitance in the feedback of the amplifier. Noise on the output of the amplifier has been reduced by using twin-ax to connect the decoder to the amplifier rather than coax. Noise can be still further reduced by filtering the d-c supply inputs to the amplifier if necessary. The noise on the display scopes in room 224 can be reduced by grounding the scopes with a heavy Whirlwind ground.

5.0 INSTALLATION AND POWER

5.2 Power Supplies and Control

(R. Jahn)

Emergency Filament Voltage Supply

The ideal voltage increments have been determined and several automatic switching systems are under consideration. WWI filament resistance as a function of voltage has been measured.

Thermistors

The thermistor voltage reference used in the -48 volt supply has a considerable time lag before reaching steady state voltage on cold mornings. Resistance measurements as a function of temperature have been made to determine what circuit changes are needed in the -48 volt supply.

(G. A. Kerby)

Whittemore power supplies were revised to give a full complement of voltages, and a temporary distribution system was installed.

(J. J. Gano)

A thesis proposal, "Dynamic Analysis of Regulated D.C. Supplies for Large Loads" has been completed.

6.0 BLOCK DIAGRAMS

(J. H. Hughes)

The drafting room is making the changes in the "Control Matrix Output Connections", drawing D-35146, which will bring it up to date. Main changes are: change qe to ex, eliminate the "run backwards" command, and make rf* take its place.

The block sketch of Programmed Marginal Checking Control is finished.

7.0 CHECKING METHODS

7.1 Test Programs

(D. A. Kemper)

The memorandum describing the trouble-location programs is being issued as M-1384, "Trouble Location Procedures."

7.4 Marginal Checking

(J. H. Hughes)

Programmed marginal checking is being held up until some bugs in the marginal checking system are ironed out. In the meantime minor changes and corrections in the Programmed Marginal Checking Control panel will be made.

(R. E. Hunt)

The marginal checking control system continues to be fairly unreliable. The automatic control has been redesigned and a prototype unit is now operating and giving considerably better operation.

The system as a whole, however, is suffering from an obsolete cross-bar switch, and too many modifications. There is also an internal short circuit in the cross-bar switch. It has been decided that, in view of the poor condition of the system, program marginal checking would not be added to it but held until the marginal checking control can be redesigned and replaced. A proposal for a new marginal checking system, M-1124, was submitted June 6, 1951. This will now be compared with a proposal to be made by Norm Daggett. A new system will be worked out on this basis at the earliest date possible.

8.0 MATHEMATICS, CODING, AND APPLICATIONS

8.1 Operation

(J. T. Gilmore)

During the past bi-weekly period the Mathematics group used 39 hours and 36 minutes of computer time. Six hours and 30 minutes were lost due to computer trouble. Our percentage of usable time was 84%. The following is a record of how the computer time was put to use.

Problem #	Title	Time used Hours	Minutes
4	Floating Point and Extra Precision Interpretive Subroutines		42
7	Industrial Problem C	1	
8	Magnetic Flux Density Study		29
9	Oil Reservoir Depletion Study	2	18
13	Point-by-Point Scope Plotting of Calibrated Axes	1	23
23	Storage Print-Out Routines	3	25
26	Subroutine Orientation Procedures	6	16
30	Digitally-Controlled Milling Machine Problem		23
38	Typewriter Print-Out for Subroutines		22
40	Conversion Read In Methods Using Photoelectric Reader and Magnetic Tape	3	47
42	Spherical Waves - Numerical Integration of Hyperbolic Partial Differential Equations via Characteristics	1	32
45	Crystal Structure		24
	Conversion of Flexowriter Tapes to 5-5-6 Binary Tapes	3	55
	Conversion of Old Coded Flexowriter Subroutines to the new code	2	40
	Demonstrations	4	30

Total number of programs operated = 80

8.0 MATHEMATICS, CODING, AND APPLICATIONS (continued)

8.2 Procedures

(J. T. Gilmore)

A new method of typing standard Flexowriter tapes will go into effect in the next bi-weekly period. Instead of typing program words in single columns on printed forms which indicate the address of each words' storage location, the tape room personnel will type four or five words to a line on lined IBM continuous stock paper. The address of the first word of each line will be typed first and then four or five words depending on whether the program is in octal or decimal form. By typing the address on each line the typist will prevent herself from getting out of place in reading from the program form. The conversion programs have been modified to check the address of the first word of each line with that of the typed address so that no program will be transferred to storage unless each word has been transferred to its correct storage location. Other advantages of the system include the elimination of resetting the Flexowriter margin lock, no longer requiring that a typist devote her full attention to a unit when it is merely reprinting a tape (because there will be no margins to reset or paper to replace), and by reducing the number of carriage returns the strain on the carriage unit will be decreased. Although programmers are not accustomed to reading their programs horizontally the printed forms will be useful in checking storage print-outs since the latest storage print-out program (mentioned in the last bi-weekly report) produces printed data in exactly the same form as described above.

A new set of preset parameters has been introduced into the conversion program's vocabulary. It is to be used only by interpretive or control subroutines. The new parameters are referred to by x, x1, x2, x3, x4...x8. The regular parameters are referred to by 0, 1, 2, 3, 4, 5,...15.

In order to continue the programming of the photoelectric reader to magnetic tape to electrostatic storage conversion program, it was necessary to write a program which would test how many lines of data from the photoelectric reader while both pieces of equipment were running at full speed. It was found that with very short and rapid recording and reading routines a maximum number of sixteen lines can be recorded between "qr" instructions. The new conversion method proposed by C. W. Adams only calls for 12 recorded lines so that we will be able to operate with a fair amount of safety.

A problem which has been put on the IBM equipment in the MIT Statistical Services Department by Frank Verzuh is being programmed for Whirlwind by Mr. Verzuh. In conjunction with this problem a conversion program is being written which will convert paper tape data prepared by the IBM equipment to the binary form required by Mr. Verzuh's program. If this procedure proves to be efficient, cooperation between the two kinds of computers would greatly increase their capabilities.

8.0 MATHEMATICS, CODING, AND APPLICATIONS (continued)

8.2 Procedures (continued)

(J. W. Carr III)

The five-hole tape punch has been finished by the machine shop, and is now available in the tape room for hand corrections. Also two one-hole hand punches similar to train conductors punches are available for inserting one-hole corrections.

It seems possible to use the present conversion program with its addition and subtraction of parameters to make the amount of storage of subroutines a variable depending on apreset parameter. Thus it may be possible to store longer subroutines covering several alternatives on tape, with the programmer selecting one or more of the alternatives by preset parameters, and the machine sorting the instructions for the ones pertinent. A further study of this is in progress.

(F. Helwig)

Conversion programs that will convert decimal coded numbers to the form used by (45, 0, 0) and (60, 0, 0) interpretive subroutines have been written and are being typed and tested. The conversion proceedure is the same as that described for (24, 6, 0) numbers in section 8.2 of the January 4 bi-weekly (M-1364). A similar conversion program for (30, 0, 0) numbers has been rewritten to function with the new flexowriter equipment.

(J. Frankovich)

An input program for decimally coded (15, 15, 0) numbers has been written and is being tested. By use of this program and the same special techniques previously described for (24, 6, 0) numbers and (30, 0, 0) numbers hand conversion of (15, 15, 0) numbers to a form that Gilmore's conversion program can handle is avoided.

8.3 Problems

(J. W. Carr III)

The Boolean matrix problem has been changed to correct previous errors due to failure to reset automatically, and is now ready for random numbers. The set of 100,000 random numbers in the Kendall-Babbington tables is available on punched cards at the Institute here, and a punched card to paper tape converter will provide raw data for machine processing. This will give a large permanent storage for random numbers on tape, which can be converted to 5-5-6 (fast input) form.

8.0 MATHEMATICS, CODING, AND APPLICATIONS (Continued)

8.3 Problems (Continued)

(J. W. Carr III) (Continued)

The boundary value conditions for the Sloan laboratories partial differential equation of the engine exhaust have been coded up in (24,6,0) floating point form and are now under test. Other boundary conditions will be worked out soon. Meanwhile, the coding of the differential equation itself is under way.

Three ordinary differential equation programs are under way. In addition to the Torpedo equations (Mr. Kramers), Dr. Laning of Instrumentation laboratories is coding a general two-point Runge-Kutta method, while Carr and Neeb have begun a general fifth-order method. Both of these should begin test in the next bi-weekly period, and perhaps be ready for general use thereafter.

(F. Helwig)

A new problem (#48) concerning gust loads on rigid air planes in two degrees of freedom has been submitted by Mr. Brenner of the Aero-Elastic and Structure Research Lab (M.I.T.). The problem consists of the solution of a pair of simultaneous integro-differential equations which have been put in finite difference form. Coding will be done for the most part by Mr. Brenner.

The first part of the problem will consist of the evaluation of a convolution type double integral by the trapezoidal rule. Mr. Brenner has written a program to do this which is being typed and tested.

(J. Frankovich)

#30. John Runyon has written a new version of the program for preparing NMM coded instructions for the milling machine. By means of the new program instructions for circular arcs of various radii, length and orientation can be prepared. Use is made of the (30,0,0) number system.

#49. Mssrs. Duke and Dailey of Project Meteor have coded a program for the integration of ten simultaneous first order differential equations which determine the path of a projectile. The (24,6,0) number system is used. Several solutions will be computed using different initial values.

8.0 MATHEMATICS, CODING, AND APPLICATIONS (Continued)

8.3 Problems (Continued)

(D. G. Aronson)

A tape (912) has been prepared for the first phase of the crystal structure problem (#45). This tape is expected to yield results for direct comparison with some previous work which has been done on IBM equipment.

A successful integration of the Univin Equations (problem #42) has been carried out. The results check with those published by Univin . Further work on this problem is planned for the coming bi-weekly period.

A conference was held with Mr. Tsai of the Sloan Laboratory and Mr. J. W. Carr concerning Tsai's problem (see previous bi-weekly). Methods of mechanizing Tsai's problem are being considered.

The question of interpretive routines for matrix operations has also been considered. A number of basic routines have been written. Work will continue along these lines.

(E. A. Kopley)

Mr. Gerard D. Galletly of the Civil Engineering Department, M.I.T., is now programming the "Solution of a Pin-Connected Lattice-Type Structure Statically Indeterminate to the Sixth Degree or Higher". It has been tentatively decided that (15,0,0) would give sufficient accuracy.

(J. D. Porter)

We now have a revised program to carry out the solution of the non-linear magnetic tape problem utilizing double-length programmed arithmetic. This program will be tested as soon as possible. The main program has been written for a time step Δt of .01 μsecs. By reading in short parameters, the program can be conveniently changed to give results for values of Δt = .001, .002, .005, .02, .05, and .1 μsecs. Results will also be obtained for various values of the applied magnetic field.

8.0 MATHEMATICS, CODING, AND APPLICATIONS (Continued)

8.4 Subroutines

(J. W. Carr III)

Revision of the matrix routines for floating point is under consideration and will be begun soon.

The following subroutines have been written:

Print Decimal Integers from AC, Zero Suppression, Final Zero, Plus and Minus Signs

Same as above, but Print from Electrostatic Storage

(F. Helwig)

The following subroutines have been written and are in the process of being typed and tested.

PA5.10t : Operations on real (45,0,0) fixed-point numbers (This subroutine does not contain a sign agreement routine.)

OT105.10t - Output typing for (45,0,0) subroutines which do not contain sign agreement.

PA6.10t - Operations on real (60,0,0) fixed-point numbers (This subroutine does not contain a sign agreement routine.)

OT109.10t - Output typing for (15n,0,0), n = 1,2,3,..., interpretive subroutines which do not contain sign agreement.

(D. E. Lenihan)

The following subroutines were received in the Library:

ED1.1t - Programmed Whirlwind I Operation (Interpretive)(15,0,0)
ED1.2t - Octal Print of PC and Address Section of Instruction on sp or cp (-) only.
ED1.3t - Print Function Letters for Error Diagnosis
OC1.3t - 1st Quadrant Axis Display
OC1.4t - 2nd Quadrant Axis Display
OC1.5t - 3rd Quadrant Axis Display
OC1.6t - 4th Quadrant Axis Display
OT1.3t - Print C(AC) as Octal Number, Sign Digit and Complement, Point, Single Column Layout.
OT2.51t -Print C(AC) as Decimal Integer, Magnitude Only, Initial Zero Suppression, Print Final Zero, No Layout

8.0 MATHEMATICS, CODING, AND APPLICATIONS (Continued)

8.4 Subroutines (Continued)

(D. E. Lenihan) (Continued)

PA3.5t - Operations on Real (30,0,0) Fixed Point Double Register Numbers (General Routine with Sign Agreement)
PA3.10t- Operations on Real (30,0,0) Fixed Point Double Register Numbers (Short, Fast Routine without Sign Agreement, giving 28 Binary Digit Accuracy in mr)
VM11.1t- Generate Scalar Matrix, Symmetric Form, From Scalar Stored in Accumulator, Matrix Order as Program Parameter (15,0,0)

(E. S. Kopley)

A subroutine for displaying octal integers with suppression of initial zeros and with a "+" or "-" followed by the magnitude of the number has been written.

A subroutine to display (24,6,0) multiple register accumulator decimal numbers has been written. The programmer can display as many numbers as he pleases. One picture can display two columns of 18 numbers each. After 36 numbers have been displayed the subroutine automatically indexes the camera. In addition the subroutine automatically indexes the camera after the last number has been displayed.

(M. Demurjian)

As soon as the tests are completed subroutines for octal instruction from storage, octal numbers from storage and decimal fractions with last digit containing round-off of additional digits will be submitted to the library.

Routines are being written to print C(AC) and C(V3) through C(V4) for octal numbers as sign and magnitude with layout.

9.0 FACILITIES AND CENTRAL SERVICES

9.1 Publications

(Anola Ryan)

The following material has been received in the Library, Room 217, and is available to all Laboratory Personnel.

LABORATORY REPORTS

No.	Title	No. of Pages	Date	Author
E-440	WWI Operating Speed	8	12-21-51	R. P. Mayer
E-442	Analysis of Vacuum Tube Failure Data	6	1-8-52	L. Sutro, H. B. Frost, M. Mackey
E-443-1	Interface Formation in 6AG7 Tubes	5	1-25-52	H. B. Frost
E-444	Changes in Design of the rc and rd Orders	3	1-31-52	E. S. Rich
M-1368	December 1951 Storage and Research Tube Summary	4	1-10-52	H. E. Cooke
M-1377	Internal Documents on Ferromagnetic and Ferroelectric Cores	3	1-18-52	W. N. Papian
M-1378	Bi-Weekly Report, January 18, 1952	32	1-18-52	
M-1379	Trips to ERA and University of Illinois (FOR INTERNAL DISTRIBUTION ONLY)	3	1-21-52	C. L. Corderman
M-1380	Symposium on Williams'-Tube Storage (FOR INTERNAL DISTRIBUTION ONLY)	5	1-22-52	T. S. Greenwood
M-1381	Magnetic-Core Memory Matrix Analysis (Effect of Driver Impedance)	4	1-24-52	D. A. Buck
M-1383	Block Diagram of the Buffer Drum System	5	1-25-52	E. S. Rich
M-1385	Subroutine Procedures	1	2-4-52	D. E. Lenihan
M-1394	Tape Preparation Procedure	2	1-28-52	C. W. Adams
A-99-2	Fire Drills - Barta Building	3	1-24-52	S. L. Hepp
A-119	Supplement: Admission of Project Lincoln Personnel	1	1-30-52	J. C. Proctor

LIBRARY FILES

No.	Identifying Information	Source
.004	European Scientific Notes: November 1, December 15, 1951	ONR/London
47	Technical Information Pilot: October 4, October 18, November 20, November 29, 1951	ONR/Library of Congress
113	General Radio Experimenter: January 1952	General Radio Co.
597	Reports on Research: January 1952	MIT
747	Research Activities of the Institute for Numerical Analysis: July through September, 1951. NBS Report 1338	National Bureau of Stds.
748	Projects and Publications of the National Applied Mathematics Laboratories. Quarterly Report July through September, 1951. NBS Report 1282	National Bureau of Stds.

9.1 Publications, Continued

LIBRARY FILES, Continued

No.	Identifying Information	Source
1669	Iron-Cored Coils for Use at Audio Frequencies. Reprints from Teneral Radio Experimenter 1936-47.	L. B. Arguimbau, P. K. McElroy, R. F. Field, General Radio Co.
1670	Whirlwind I Programmers' Manual (Rough Draft)	C. W. Adams
1671	Nuclear Science Abstracts. Volume 6, No. 2: January 31, 1952	Atomic Energy Commission
1672	Design News: January 1, 1952	
1673	An Amplitude Distribution Analyzer. NRL Report No. 3890. December 29, 1951	A. M. King
1674	A Direct-Writing Feedback Recorder. Engineering Report No. 33. October 15, 1951	R. Scheidenhelm, Servomechanisms Lab.
1675	High Frequency Ultrasonics. II: 280 to 560 mc/sec. Technical Report No. 151. April 15, 1950	R. A. Rapuano, Research Lab. of Electronics/MIT
1676	Problems in the Application of Oriented Nickel-Iron Alloys. January 21, 1952	A. C. Beiler, Westinghouse Electric
1677	Microcores	Magnetic Metals Co.
1678	Telemetering Ground Station. Progress Report No. 20-143. September 24, 1951	J. H. Keyser, Jet Propulsion Lab.
1687	A Report on New Recording Means and Computing Devices. September, 1951	M. E. Davis, Metropolitan Insurance Co.
1686	Research Abstracts: Nos. 13, 14, 15, 16	NACA
1688	Electric Sorter for Population Census and Opinion Poll, etc.	H. Yamashita, Tokyo University
1689	Summary of A. I. E. E. Computing and Computing Papers 1949-1951	A. I. E. E.
1690	Technical Data Digest: January, 1952	C. A. D. O.
1691	Catalog of Digital Computer Designs	J. H. Felker, Bell Telephone Labs.
1692	A Colloquium on Non-Linear Vibrations. Technical Report ONRL-128-51	F. J. Weyl, ONR/London

Journals

Bell System Technical Journal: January 1952
General Electric Review: January 1952
Mathematical Tables and Other Aids to Computation: October 1951
Oil and Gas Journal: January 21, 1952
U. S. Government Publications: Monthly Catalogue: January 1952

Books

Catalogue: American Television Institute: Curriculum for the Degree Bachelor of Science in Television Engineering
World Almanac: 1952

9.2 Procurement and Stock

(H. B. Morley)

There have been many instances wherein persons requisitioning material have requested increases or changes after the orders have been processed. Such instances cause a great deal of additional work due to the necessity of making changes in orders, ratings, allocations, prices, deliveries, etc., and also increase paper work in the DIC Office. Therefore it would be advisable to give every thought in advance to the possible need for additional units and spares, and to the correct specifications. Many requests do not provide for sufficient quantities as is shown by the number of repeat orders placed. All requests should be submitted on the work sheet provided, always stating the use of the items requested.

Catalogues, Instruction Manuals and other specifications that are removed from this Dept. without authorization have always been a source of lost time and annoyance. Lately purchase orders and similar records have occasionally gone astray. Catalogues and similar reference material may be taken for short periods if properly signed out. Purchase orders and records must never be removed from the Purchasing Office.

We do not wish to make this report sound like a "Bi-Weekly Complaint" but only those of us involved can realize the actual troubles caused by departures from correct procedure.

Many of the special transformers for spares and proposed additional construction have been ordered. In several instances, the vendor has been changed in the interest of better quality and price.

Orders have been placed for storage tube mount boxes and shields. Delivery will depend upon the availability of mu-metal.

In general, delivery promises and performances remain poor, although delivery of some outstanding items has been accomplished through expediting.

Standards

(H. W. Hodgdon)

Standards sheets were approved for issue on pulse transformers and cores, and on several filter chokes and filament transformers. Sheets for relays are completed and will be issued shortly. Rough drafts have been prepared for glass-enclosed fuses, plastic casting resins, and composition resistors.

A complete file of military specifications for electronic components has been received.

9.2 Standards (continued)

(H. W. Hodgdon) (continued)

During the interim period between now and the completion of the standards book, anyone needing information on status of components not covered in the new standards book should contact me or some member of the Committee. This might forestall use of some component which is being deleted from our standards.

9.3 Construction

(F. F. Manning)

Production Report

The following units have been completed since January 18, 1952:

6 Delay Line Amplifiers
1 Storage Tube Monitor
1 L. V. Floating Power Supply
2 500/400/300 V, 5 amp Regulator
80 Video Cables

The following units are under construction:

80 Video Cables
2 600/500/400 V 5 Amp. Rectifiers
2 ESD Output Panels
1 IOC Counter FF01 (Mod. DC In-Out Register)
1 IOC Counter FF03 (Mod. DC In-Out Register)
1 Photoelectric Tape Reader Control
2 Array Switch Drivers
15 Mounting and Cabling D. C. Bench
30 Delay Lines

9.4 Drafting

(A. M. Falcione)

1. New Drawings:

A. 420 In-Out Switch, Display Matrix

Drawings for this unit are complete except for grading
Circuit Schematic D-50720
Assembly & PL D-50753
Al. Panel Detail D-50754

B. Master WWl Bill of Materials:

The master bill of materials for WWl was issued last week and is dated as of January 2, 1952. The first two sheets list all the known units and quantities of existing panels. I have been informed that the quantities of certain panels should be increased. Arrangements have been made with Hal Mercer to keep this office informed of any panels being added to WWl.

C. DC Bench Outlet Box:

A new design for the DC Bench Outlet Box for laboratory Bench power is now being considered, and will be known as Mod III. This box will be much larger than the existing models. Any new procurement or manufacture should be made to the new design.

D. Installation Cover, Vertical Fusing strips racks EO-El5 & E6:

This drawing is now complete and ready for grading.

E. Marginal Checking Generator, Test Panel:

The drawings for this unit are complete and graded.
Circuit schematic: B-50608
Assembly & PL D-50610
Al. Panel D-35537
This unit replaces the blank panel in rack 8 in the basement power room at the Barta Building.

F. Whittemore Building Drawings:

The drawings for the Whittemore Building will be complete within the next week including all floor layouts.

2. Multilith Machine:

A memoranda is being written with reference to the operation and procedure to be followed. The trial run which was made last week was very satisfactory. All secretaries are again cautioned against finger prints. Masters must not be folded. Special transmitting envelopes for this purpose are now on order.

10.0 GENERAL

(John C. Proctor)

New Staff

John Baldridge is a new staff member working on magnetic materials. He has his B. S. in Chemistry from Juaniata College. He was a research assistant with U. S. Steel for several months.

Robert J. Callahan is a new research assistant working on transistors with John Jacobs. He has his B. S. in E. E. from M. I. T. and was an Air Force pilot for four years.

Sylvio Desjardins is a new staff member working on the WWI Computer operation. He has a B. S. in E. E. from Northeastern University. For three years he was an engineer with I. B. M. and with Western Electric.

Roy E. Hegler is a new staff member in the storage tube group. He has a B. S. in Engineering from the American Television Institute and was for two years an engineer with Westinghouse Electric.

Thomas Hilton is a new staff member working with Bob Nelson. He has a B. S. from M. I. T. in Economics and Engineering. He has been Assistant Dean of Students at M. I. T. for three years and was an Air Force pilot for three years.

Willian A. Hosier is a new staff member working with Taylor. He has a B. A. from Oberlin and an M. A. from Harvard, both in Math. He has been an actuary at the Monarch Life Insurance Co. for four years, and before that was on the staff at the Radiation Lab, M. I. T.

Helmut D. Neumann is a new research assistant working on magnetic materials. He has a B. S. in E. E. from City College, New York.

Hawley K. Rising is another research assistant working with Brown on magnetic materials. He was a test engineer with General Electric for several months.

Julius Woolf is a new staff member working with Papian. He has his B. S. and M. S. in math from New York University. He has been an assistant engineer with Bendix Aviation for a year.

10.0 General (continued)

New Non-Staff

Charles Alexander is a new laboratory assistant in the electronic shop. He has had experience as a technician with the Air Force and the AeroVox Capacitor Corp.

Charles Greim is a laboratory assistant who was a technician in the Marines for two years.

Charlebert Ingram is a new secretary in the storage tube group. She has attended Ohio State University and has been a secretary for several years.

Donald Main is a cooperative student from Northeastern with the storage tube group.

Frank McCorrison is a laboratory assistant working with Adams' group.

Noble Pribble is a new part-time student working on transistors.

William Teicher is another part-time student also working on transistors.

Terminated Staff

David Kemper has accepted a position with Burroughs Adding Machine Co.

Terminated Non-Staff

Harold Scharn has transferred to Project Lincoln.

Rafael Schapiro.

Francis Van Wyk.